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JULY 1985 NUMBER 203

MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

July 1985 No. 203

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To Our Readers

We are pleased to announce that **Bob Alexander, Katie Bowen,** and **Earl Hoellen** have been elected vice presidents of Nuexco.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

The **Exchange Value** as of June 30, 1985, is **$15.00** per pound U_3O_8, unchanged since last month. **Active supply** of natural uranium (U_3O_8 and UF_6) for spot or near-term delivery totals **3,520,000** pounds equivalent U_3O_8 as concentrates or UF_6, up 865,000 pounds since last month. The corresponding figure for **active demand** is **1,325,000** pounds, up 385,000 pounds. The spot and near-term **supply-demand ratio** fell to **2.7:1**.

The *Current Market Data* section of this Report lists eight natural uranium sales transactions, involving a total of approximately 1,500,000 pounds U_3O_8 equivalent. All of the transactions reported this month involved deliveries before 1986, and seven met the criteria for inclusion in the current Transaction Value calculation.

The **UF_6 Value** as of June 30, 1985 is **$42.50** per kilogram U as UF_6, unchanged since last month. Three of the transactions reported this month involved UF_6.

The **Transaction Value** as of June 30, 1985 is **$14.60** per pound U_3O_8, up $0.15 since last month. The current Transaction Value includes 17 transactions involving a total of 4.6 million pounds U_3O_8 or equivalent UF_6 and covers a period of 3 months.

The Loan Use Charge Rate as of June 30, 1985 is unchanged at **5 percent** per annum, as lenders continued to offer substantial quantities of material at that rate.

* * *

The Exchange Value remained at $15.00 this month as material available at prices below that level ostensibly was cleared from the market. One US utility sold its remaining inventory to trading firms during the month at prices at or near the current Exchange Value. The trading firms then reoffered the material to end users during the month. It appears that the end users eventually paid prices near the current Exchange Value for that large amount of inventory material. At the end of the month, market activity diminished, prices stabilized, and the gap between sellers' offers and buyers' bids widened somewhat. As a result, discretionary buyers and sellers now dominate the market. Sellers without immediate need to dispose of material currently are holding out for higher prices. However, the lack of both firm demand and buyers willing to pay above $15.00 precludes a rise in the Exchange Value until fundamental conditions change.

Traders, apparently believing the market has reached a bottom, have been active and aggressive participants in the market, often appearing as the first and most competitive buyers when inventory becomes available for sale. This phenomenon has been evident on a number of occasions in the past few months, and the thin, highly discretionary demand situation has, in several instances, resulted in material passing through several parties before reaching the end user. The appearance of merely one firm buyer elicits the vigorous competition among sellers that is typical of buyers' markets in general. In addition, however, the increasing activities of trading firms are responsible for amplifying the price effects of each instance of firm demand. Whenever such an opportunity presents itself, trading firms concentrate on filling the demand, often offering to buy elsewhere to service that opportunity. Thus, a single, widely known instance of firm demand for a relatively large quantity can, through the amplifying effect of traders, give other market participants the impression that demand is several times greater than it actually is.

There are few *fundamental* differences between the present market situation and that which has existed throughout 1984 and early 1985. There is very little near-term hard demand (i.e., demand for uranium needed now to run reactors), and what demand there is can be classified as soft demand (i.e., buying by trading firms gambling on the firming up of prices, or discretionary buying by end users who are taking advantage of current low prices to partially satisfy future demand). A price recovery is difficult in such circumstances because soft demand will not aggressively follow prices up. Normally, this will only occur when demand strengthens. However, there is so little hard demand in the near-term market that it is difficult to conceive of aggressive buyers bidding up prices. As in the past, a recovery initially will be based upon buyer and seller *perceptions* of a stronger market before actual changes in supply and demand take effect. A similar recovery in 1983 continued for a year before losing momentum and deteriorating in the face of oversupply, decreased demand due to plant cancellations, and the implementation of the US enrichment contract.

* * *

The UF_6 Value remained at $42.50, primarily due to the general lack of demand in the present market. The active supply of UF_6 is greater now than in recent months, and thus the value of UF_6 is slightly less than the sum of the Exchange and Conversion Values.

* * *

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PRICING

The **Conversion Value** is **$1.60** per pound U as UF_6, up $0.10 since last month as the leading seller of secondary market conversion services vacated the market. One secondary market conversion transaction is reported. Active supply of secondary market conversion services for delivery within three years totals 1.7 million pounds U as UF_6. Active secondary market demand for conversion amounts to 365,000 pounds U as UF_6.

The secondary market for conversion services remains marginally active, with transaction prices stabilized slightly above the $1.50 level. With one supplier out of the market and demand at a minimum, little activity is expected in the coming weeks.

ENRICHED URANIUM AND SWUS

The Nuexco **SWU Values** as of June 30, 1985 are:

1. For **DOE origin,** a tails assay of 0.30 weight-percent U_{235}, for delivery by the end of FY86, and certifiable as excess, $88 per SWU, down $2.

2. For **other** SWUs (includes DOE origin SWUs not certifiable as excess and non-DOE origin SWUs), for delivery by the end of calendar year 1986, $83 per SWU.

One secondary market SWU transaction is reported, involving 100 to 300 thousand SWUs.

* * *

Activity in the markets for SWU of either DOE-certifiable or other origin fell to a minimum in June following the completion of one transaction. Because it was the first firm buyer of a large quantity in some time, fierce seller competition preceded the sale. The buyer was able to obtain a very low price due to the seller competition and complete lack of any other demand.

Sellers of DOE-certifiable SWUs continue to look for opportunities for FY86 SWU, but active demand for either FY85 or FY86 SWUs is limited. As in the past few months, buyers with FY86 requirements are evaluating purchasing strategies and are not compelled to act immediately. Most utilities have filled their requirements, so the FY86 buyers have controlled the market by their emergence for occasional purchases, a situation which has driven down the prices. Nuexco expects sporadic demand to continue for the rest of the year.

The market for other SWUs remained dormant throughout the month. As in the DOE-certifiable SWU market, lack of demand hinders activity and facilitates lower prices when a firm buyer appears. Very little demand is expected in the near term, although some negotiations for 1986 deliveries are continuing.

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CURRENT MARKET DATA

June 30, 1985	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$15.00**/lb. U_3O_8	3,520	1,325
UF_6 VALUE	**$42.50**/kgU		
CONVERSION VALUE	**$1.60**/lb. U as UF_6	1,660	365
SWU VALUES			
DOE origin, certifiable as excess, 0.3 tails assay delivery by the end of FY86	**$88**/SWU		
Other SWUs (non-DOE or non-certifiable) delivery by the end of calendar year 1986	**$83**/SWU		
LOAN USE CHARGE RATE	5%/annum	0	300

TRANSACTION VALUE	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
	14.60	4.6	17	3

[1]Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Values** represent Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Use Charge Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to offer, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not considered in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the DOE SWU Values, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminant variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (June 30, 1985)	Last Month (May 31, 1985)	12 Months Ago (June 30, 1984)	This Month (June 30, 1985)	Last Month (May 31, 1985)	12 Months Ago (June 30, 1984)
Australia (dollar)	22.50	22.56	20.21	58.49	58.64	52.55
Belgium (comm. franc)	921.94	931.68	992.06	2,396	2,422	2,579
Canada (dollar)	20.45	20.64	23.03	53.16	53.67	59.87
Finland (markka)	95.12	95.97	103.24	247.28	249.50	268.41
France (franc)	139.41	140.98	149.57	362.42	366.51	388.86
FRG (mark)	45.76	46.30	48.71	118.96	120.36	126.62
Italy (lira)	29,222	29,492	30,027	75,972	76,674	78,065
Japan (yen)	3,732	3,773	4,152	9,703	9,810	10,794
Netherlands (guilder)	51.69	52.16	54.88	134.38	135.59	142.67
South Africa (rand)	29.50	29.97	23.68	76.69	77.92	61.56
Spain (peseta)	2,619	2,612	2,766	6,810	6,792	7,191
Sweden (krona)	132.04	133.45	143.09	343.28	346.95	372.00
Switzerland (franc)	38.34	39.00	40.75	99.68	101.40	105.93
UK (pound)	11.58	11.77	12.94	30.11	30.61	33.65
US (dollar)	15.00	15.00	17.50	39.00	39.00	45.50

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (June 30, 1985)	Last Month (May 31, 1985)	12 Months Ago (June 30, 1984)	This Month (June 30, 1985)	Last Month (May 31, 1985)	12 Months Ago (June 30, 1984)
Australia (dollar)	21.90	21.73	19.06	56.93	56.49	49.55
Belgium (comm. franc)	897.36	897.52	935.37	2,332	2,333	2,432
Canada (dollar)	19.90	19.89	21.71	51.74	51.70	56.45
Finland (markka)	92.58	92.45	97.35	240.69	240.35	253.08
France (franc)	135.69	135.81	141.03	352.76	353.07	366.64
FRG (mark)	44.54	44.60	45.92	115.79	115.95	119.39
Italy (lira)	28,443	28,411	28,312	73,946	73,863	73,604
Japan (yen)	3,632	3,635	3,915	9,444	9,450	10,177
Netherlands (guilder)	50.31	50.24	51.74	130.80	130.62	134.51
South Africa (rand)	28.71	28.87	22.33	74.64	75.06	58.05
Spain (peseta)	2,549	2,516	2,608	6,628	6,543	6,780
Sweden (krona)	128.52	128.56	134.91	334.13	334.22	350.75
Switzerland (franc)	37.32	37.57	38.42	97.03	97.68	99.88
UK (pound)	11.27	11.34	12.20	29.31	29.49	31.73
US (dollar)	14.60	14.45	16.50	37.96	37.57	42.90

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on June 28, 1985.

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CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U as UF_6			per kg. U as UF_6		
	This Month (June 30, 1985)	Last Month (May 31, 1985)	12 Months Ago (June 30, 1984)	This Month (June 30, 1985)	Last Month (May 31, 1985)	12 Months Ago (June 30, 1984)
Australia (dollar)	2.40	2.26	0.00	5.29	4.97	0.00
Belgium (comm. franc)	98.34	93.17	0.00	216.80	205.40	0.00
Canada (dollar)	2.18	2.06	0.00	4.81	4.55	0.00
Finland (markka)	10.15	9.60	0.00	22.37	21.16	0.00
France (franc)	14.87	14.10	0.00	32.78	31.08	0.00
FRG (mark)	4.88	4.63	0.00	10.76	10.21	0.00
Italy (lira)	3,117	2,949	0.00	6,871	6,502	0.00
Japan (yen)	398.11	377.36	0.00	877.68	831.93	0.00
Netherlands (guilder)	5.51	5.22	0.00	12.16	11.50	0.00
South Africa (rand)	3.15	3.00	0.00	6.94	6.61	0.00
Spain (peseta)	279.43	261.28	0.00	616.03	576.02	0.00
Sweden (krona)	14.08	13.35	0.00	31.05	29.42	0.00
Switzerland (franc)	4.09	3.90	0.00	9.02	8.60	0.00
UK (pound)	1.24	1.18	0.00	2.72	2.60	0.00
US (dollar)	1.60	1.50	0.00	3.53	3.31	0.00

SWU VALUES AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	DOE SWU Delivery by the End of FY86 (June 30, 1985)	Non-DOE SWU Delivery by the End of CY86 (June 30, 1985)	UF_6 Value per kg. U in UF_6 This Month (June 30, 1985)	UF_6 Value per kg. U in UF_6 Last Month (May 31, 1985)
Australia (dollar)	131.99	124.49	63.75	63.91
Belgium (comm. franc)	5,408	5,101	2,612	2,639
Canada (dollar)	119.96	113.14	57.93	58.49
Finland (markka)	558.02	526.32	269.50	271.91
France (franc)	817.84	771.38	394.98	399.44
FRG (mark)	268.46	253.20	129.65	131.17
Italy (lira)	171,439	161,698	82,797	83,562
Japan (yen)	21,895	20,651	10,574	10,691
Netherlands (guilder)	303.24	286.01	146.45	147.77
South Africa (rand)	173.06	163.23	83.58	84.92
Spain (peseta)	15,368	14,495	7,422	7,402
Sweden (krona)	774.65	730.63	374.12	378.11
Switzerland (franc)	224.95	212.17	108.64	110.50
UK (pound)	67.95	64.09	32.82	33.36
US (dollar)	88.00	83.00	42.50	42.50

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on June 28, 1985.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current E.V.	Seller	Buyer	Remarks
3490	1985	601-1,000	100	US Utility	Trader	UF_6.
3488	1985	less than 50	100	Non-US Utility	Trader	UF_6.
3487	1985	50-100	104	Trader	European Utility	UF_6.
3486	1985	less than 50	98	Trader	US Utility	
3485	1985	101-300	94	European Entity	Trader	
3483	1985	50-100	99	US Producer	US Utility	
3460	1985	50-100	97	US Producer	US Producer	
3459	1985	101-300	indeterminate	Non-US Producer	US Producer	Market-related price.

Secondary Market Conversion Services

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price as Percent of Current E.V.	Seller	Buyer	Remarks
3455	1985	301-600	100	Trader	US Utility	

Enrichment Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[2] (thousands of SWUs)	Approximate Price[3] as Percent of Current SWU Value[4]	Seller Group	Buyer Group	SWU Origin	Remarks
3484	1986	101-300	R[5]	US Entity	US Utility	R[5]	

[1]Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.
[2]If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.30 w/o tails assay.
[3]Price is not normalized to 0.30% tails assay.
[4]Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage refers to the ratio of the *discounts*, not the ratio of the prices.
[5]The notation *R* means that Nuexco either does not know, or that Nuexco has restricted that information to protect client confidentiality.

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URANIUM SUPPLY
(June 30, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2134	50	220 per year	1985-87
2335*	275	—	
2389*	300	—	
2483*	545	—	
2654*	500	500 per year	UF_6
2673*	950	—	UF_6
2705A	200	—	UF_6
2728*	200	—	UF_6
2814*	500	500	UF_6
2625	—	250 per year	1987-89
2680	—	250 per year	1986-92
TOTAL:	3,520		
INACTIVE			
1860*	400	1,500 per year	
2191	125	—	UF_6
2336	250	250 per year	1985-94
2553	300	—	
2297	—	200 per year	1986-89
2670	—	525	1987
TOTAL:	1,075		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 1575, 2263, 2392, 2538, 2538B, 2594

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CURRENT MARKET DATA

URANIUM DEMAND
(June 30, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2590	75	—	U_3O_8 or UF_6
2681*	500	500	
2695*	250	500	UF_6
2750*	500	500	
2217	—	1,000 per year	1989-95
2507	—	600	1987-89
TOTAL:	1,325		
INACTIVE			
2548*	290	—	
2576	20	—	UF_6
2636*	100	—	
2457B	—	650	1987
2586	—	300	1987
2643	—	150 per year	1987 on
2694	—	625	1987; UF_6
TOTAL:	410		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 2414, 2699, 2716, 2748, 2751.

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LOAN SUPPLY AND DEMAND
(June 30, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
INACTIVE			
1938	2,000	—	UF_6
2036	500	—	
2469A	800	—	
2483	550	—	
2667	800	—	
TOTAL:	4,650		
Inquiries to Borrow:			
ACTIVE			
2606	300	—	
TOTAL:	300		

*New or revised since last month.
[1]Measured from the date of this Report.
Projects removed since last month: None.

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CURRENT MARKET DATA

CONVERSION SUPPLY AND DEMAND
(June 30, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2438*	500	250 per year	1986-87
2511	300	300	1986-90
2677	500	—	
2725	360	—	
TOTAL:	1,660		
Inquiries to Purchase:			
ACTIVE			
2419A	55	—	
2587	35	—	
2596*	—	600	
2617	275	420	1986-91
TOTAL:	365		
INACTIVE			
2529	225	—	
2724	—	375	1989-93
TOTAL:	225		

*New or revised since last month.
[1]Measured from the date of this Report.
Projects removed since last month: 2511.

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SWU SUPPLY AND DEMAND
(June 30, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2607*	200	—	
2624	100	—	
2705	40	—	
2410A	—	350	
2571	—	55	1987
2684	—	35	
TOTAL:	340		
INACTIVE			
2359*	—	200	
2378	—	120	1988
2652	—	25	1986
TOTAL:	0		
Inquiries to Purchase:			
ACTIVE			
2400	—	150	1987-90
2519	—	30 per year	1987 on
2578*	115	—	
2597	—	30	
TOTAL:	115		
INACTIVE			
2543	25	25	1986
2500	—	170	1988
2512	—	15 per year	1987 on
2595	—	50	1986
2693	—	100 per year	1989-90
2706*	—	30	
TOTAL:	25		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 2164, 2633B, 2658, 2713, 2726.

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FOCUS

BRAZIL

Introduction

Brazil's once-ambitious nuclear power program continues to slow down in the face of funding problems and bureaucratic delays. The largest country in South America (Figure 1), with a population of approximately 125 million and an area of 8.5 million square kilometers, Brazil's energy needs and distribution requirements caused the adoption of a new energy strategy aimed at increased use of nuclear energy as the implementation of hydropower reaches its limitations. In 1985, hydropower generated 85 percent of the country's electricity, a percentage that is expected to decline slightly in the future. A nuclear power development effort which began in the early 1970s led to supply and technology relationships with various reactor manufacturers and fuel cycle companies in the Federal Republic of Germany, France, and the USA. The most extensive relationship, based on a Brazilian-West German accord calling for eight 1,300-MWe reactors supplied by Kraftwerk Union (KWU), will be reevaluated in the coming months. The original completion date for all of the units receded from 1990 to 2000, and even that estimate is optimistic. At present, one reactor is in commercial operation and two are under construction, but construction is proceeding at the slowest possible rate. In addition, while Brazil aspires to self-sufficiency in its fuel cycle program, and currently has planned or begun construction on conversion, enrichment, and fuel fabrication facilities, actual completion schedules are uncertain due to financial difficulties. However, the discovery of significant assured uranium resources in at least five regions has led to rapid development of mine and mill facilities, technology and equipment.

Atomic Energy Structure

The Minister of Mines and Energy, a member of the president's cabinet, is responsible for the country's nuclear energy program. The responsibilities of the nuclear energy sector are divided between two entities under his jurisdiction. Empresas Nucleares Brasileiras SA (Nuclebras) is a holding company responsible for the execution of policy in the nuclear program. It controls all aspects of the nuclear fuel cycle, including industrial development, construction of nuclear power plants and other fuel cycle facilities, and also is involved in uranium mining and processing. Comissao Nacional de Energia Nuclear (CNEN) is a research and regulatory body that is in charge of licensing and safety concerns of all nuclear facilities in Brazil.

Electrobras is the state holding company for all electrical utilities in Brazil and also is controlled by the Minister of Mines and Energy. Its primary purpose includes forecasting the demand and growth of national energy needs and managing non-nuclear energy matters. In the early 1970s, various government agencies performed studies to determine the feasibility and desirability of implementing a nuclear program. As a result, an agreement signed between CNEN and Electrobras led to the order in 1971 of the first nuclear power plant in Brazil.

Nuclear Power Program

An Electrobras subsidiary, Central Electrica de Furnas, was the utility designated to carry out the design and construction of the nation's first nuclear plant. Furnas is responsible for 20 percent of Brazil's electrical power generation and supplies power to more than 45 million people. It operates the Angra plant, located within 100 miles of Rio de Janeiro. Angra Unit 1, a 626-MWe Westinghouse turnkey PWR, began commercial operation in December 1984. Angra Units 2 and 3 are 1,245-MWe PWRs supplied by Kraftwerk Union (KWU); Unit 2 is 62 percent complete and Unit 3, presently in the excavation stage, is one percent complete. Construction of the two units is proceeding slowly, and although Electrobras expects operation in 1990 and 1992, Furnas has not yet announced an expected commercial operation date. Plans for two additional reactors, Iguape Units 1 and 2, were recently canceled. All activities related to the units, which were to be in operation by 1995, have been postponed indefinitely by the federal government. In addition, the government has not chosen sites or utilities for new nuclear plants.

International Cooperation

Nuclebras and various enterprises in the FRG participate in most of the joint ventures for the transfer of technology and equipment to Brazil. The areas of industrial cooperation include:

1. Uranium exploration, mining and processing;
2. Construction of reactors and other nuclear facilities;
3. Uranium enrichment services;
4. The manufacture of fuel elements and reprocessing of irradiated fuels.

Brazil and the FRG formed five jointly-owned Brazilian companies in 1976 to perform various functions of the nuclear engineering program. Nuclebras is the Brazilian

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Figure 1: Brazil and South America

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shareholder in all of the companies. Figure 2 illustrates the ownership structure of the following joint companies.

NUCLEN (Nuclebras, 75 percent; KWU, 25 percent) provides project management, technical supervision of plant construction, and other aspects of nuclear power plant engineering.

NUCLEP (Nuclebras, 88.6 percent; KWU, GHH and Voest, 3.8 percent each) handles the construction and factory operation for heavy reactor components. GHH (Gute Hoffnunges Huette AG) is a subsidiary of the large FRG steel company Mannesmann AG, and Voest AG is an Austrian steel company. Both companies build reactor vessels and other heavy components.

NUCLEI (Nuclebras, 75 percent; Steag, 10 percent; Interatom, 15 percent) is conducting the construction and operation of a uranium enrichment plant that will utilize jet-nozzle techniques for isotope separation.

NUSTEP (controlled equally by Nuclebras and Steag) is responsible for developing and licensing the jet-nozzle enrichment process.

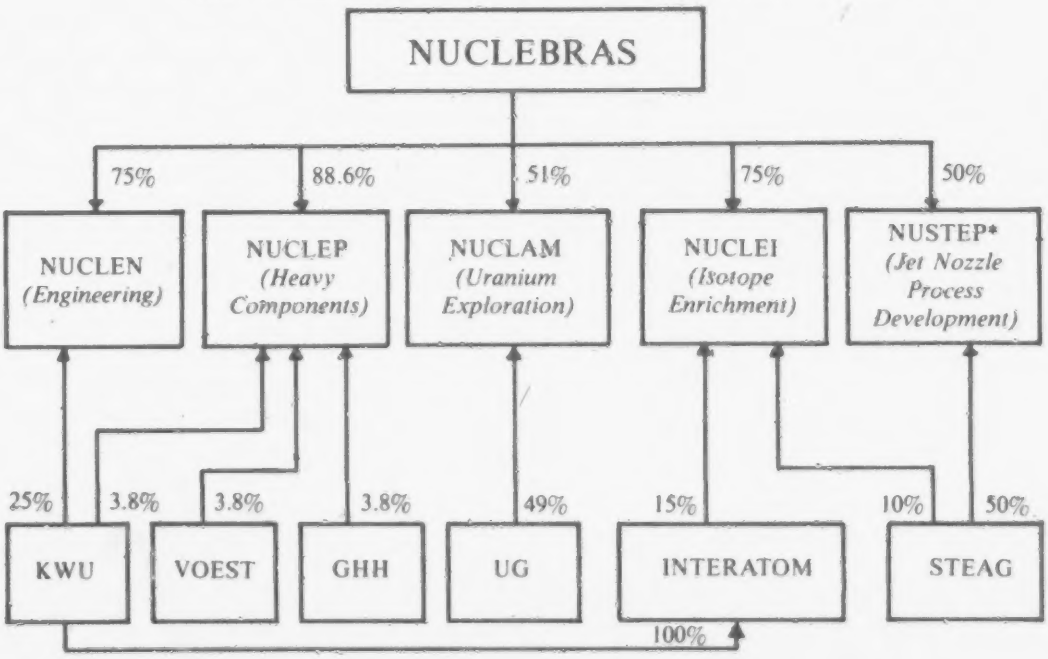
NUCLAM (Nuclebras, 51 percent; Urangesellschaft, 49 percent) is involved in prospecting, exploring and mining of uranium in Brazil.

Uranium Resources

Uranium exploration in Brazil occurred as early as 1952, when Conselho Nacional de Pesquisa and CNEN carried out small-scale explorations. In 1974 the Government established well-defined policies regarding the future development of Brazil's uranium resources. At present, Nuclebras conducts exploration through its NUCLAM subsidiary, often as a joint venture with Urangesellschaft mbH (UG) of the FRG.

Table I lists the known uranium deposits in Brazil. The only operating uranium mine and mill is located at the Pocos de Caldas mineral district in southeastern Brazil. Total uranium reserves are estimated at 26,800 tonnes U_3O_8, most of which is located at the Osamu Utsumi mine. The mine life, which in 1982 had been estimated at 40 years assuming an annual production rate of 1,200,000 pounds U_3O_8 per year, recently was reevaluated. Nuclebras now expects mine life to reach ten years with approximately a 900,000 pound U_3O_8 per year production rate. Mill output has declined from 630,000 pounds U_3O_8 in 1982 to 300,000 pounds in 1984, chiefly due to budget cutbacks in production areas. The complex currently is oper-

Figure 2: Joint Brazilian-West German fuel cycle services companies



*Incorporated in the Federal Republic of Germany.

GHH —Gute Hoffnunges Huette AG
KWU —Kraftwerk Union AG
STEAG—Steag AG
VOEST—Voest AG
UG —Urangesellschaft mbH

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ating at less than 50-percent capacity.

At present, federal law prohibits the export of U_3O_8 produced at the Pocos de Caldas facility. The uranium is used for Brazil's commercial reactor program, domestic research purposes, and to repay a uranium loan from neighboring Argentina. The law, which was enacted to protect domestic uranium requirements, also affects any U_3O_8 which may be produced at the Figueira or Amorinopolis deposits. Deposits in other locations, however, are not subject to the site-specific law, and uranium produced there may be exported.

Nuclebras plans to develop at least two other sites containing substantial estimated uranium reserves. The company recently announced its intention to build a 4,400,000 pound U_3O_8 per year mine and mill facility at Lagoa Real in Bahia. Nuclebras will solicit foreign investment, possibly from Japan or the FRG. Over 60,000 tonnes U_3O_8 of reasonably assured reserves are thought to exist at the Lagoa Real deposit. The higher quality of ore there caused Nuclebras to focus attention on plans for Lagoa Real and away from the Itataia deposit. Nuclebras and the French conglomerate Cogema had been negotiating the financing arrangements for a mine and mill complex at the Itataia site, which contains an estimated 91,000 tonnes of reasonably assured reserves, but no agreement was reached in last year's discussions. Should either or both projects be developed, the uranium produced would be available for export.

Other Fuel Cycle Activities

Facilities for conversion, enrichment and fuel fabrication are currently under development in Brazil. Ipen, a federally funded Sao Paulo research institute, began operating in October 1984 a UF_6 conversion pilot plant capable of producing 90 metric tons of UF_6 per year. However, Nuclebras and the French industrial company Pechiney-Ugine-Kuhlmann are designing a larger-scale plant to be located at the Resende fuel cycle complex near Rio de Janeiro.

The first of 24 stages of a uranium enrichment pilot plant utilizing the jet-nozzle process is scheduled to begin operation in 1985. In the jet-nozzle process, UF_6 mixed with a light carrier gas flows through a curved nozzle at high velocity and is split into two streams at the outlet. Heavy and light isotopes are separated during deflection due to centrifugal forces. The first cascade will operate using 24 jet-nozzle separation elements and will enrich uranium to one percent U_{235}. NUCLEI intends to determine the economic viability of the first stage before starting a demonstration unit with a capacity of 64,000 SWU per year in 1988 or 1989. At present, Brazil has some enriched uranium stockpiled through its two-million-SWU contract with Urenco, in anticipation of Angra Units 2 and 3 consumption. In addition, construction of a 100 MTU per year fuel fabrication plant has been completed. Pellet loading, fuel rod welding and bundle assembly processes are in operation. Pellet manufacture and UO_2 reconversion are scheduled to begin operation in 1987 and 1988, respectively.

Table 1
ESTIMATED URANIUM RESERVES IN BRAZIL
(Metric tons of U_3O_8)

Ore Deposit or Mine	Reserve Category		
	Reasonably Assured[1]	Estimated Additional[1]	Total
Pocos de Caldas (Osamu Utsumi)	20,000	6,800	26,800
Lagoa Real Province	61,840	31,350	93,190
Itataia Province	91,200	51,300	142,500
Figueira	7,000	1,000	8,000
Espinharas[2]	5,000	5,000	10,000
Other Deposits	7,500	13,500	21,000
TOTAL	192,540	108,950	301,490

[1]According to IAEA classification.
[2]NUCLAM estimates.

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JAPAN

Nuclear Plant Status

Japan's electric utilities currently are operating 28 nuclear power plants with a net generating capacity of 20,561 MWe (Table 2, Figure 3). An additional 14 units with a total net capacity of 13,858 MWe are under construction. Three of those already have achieved criticality and will enter commercial operation in 1985. The remaining 11 units under construction are scheduled to begin operation between 1986 and 1994. Although some delays may occur, Japan's demonstrated efficiency in nuclear plant construction suggests that the utilities will achieve most of these expected operational dates.

Six additional plants with a total capacity of 6,275 MWe officially have been recognized as projects and are undergoing licensing procedures (see Report 188 for a discussion of nuclear plant licensing in Japan). Commercial operation dates for these projects range from 1991 to 1994. Due to possible licensing problems or reduced utility load growth, it is conceivable that some of these dates may be deferred.

The Ministry of International Trade and Industry (MITI), the government body responsible for long-range planning of electric power generation, in 1984 established a nuclear generation objective of 48,000 MWe by 1995. Without delays, the total nuclear generating capacity of the 48 plants in Table 2 (28 in operation, 14 under construction, and 6 undergoing licensing) that could be operating by 1995 would only represent 40,694 MWe. Recently, however, the private utilities announced their *planned* nuclear plant construction program, consisting of nine additional units as shown in Table 3. Seven of the units are scheduled to begin operation before 1995, and would add 6,865 MWe to the 40,694 MWe in operation, construction or licensing, resulting in a total of 47,559 MWe by 1995. Thus, under the best circumstances the MITI goal could be realized.

Of the nine new plants in Table 3, four are scheduled to receive preliminary approval in 1986, which would permit them to initiate formal licensing procedures. The remaining five are scheduled for similar action in 1987. Hamaoka Unit 4 and Onagawa Unit 2 will be extensions of existing plant sites, and should achieve actual project status with a minimum of delays. The remaining units would be located in areas designated as potential sites by the utilities several years ago, and site negotiations with local interests are continuing. Hokuriku Electric Power Company (EPC) recently completed initial boring of its often-delayed Noto site, but is continuing negotiations with a fisherman's cooperative group strongly opposed to plant construction. Chubu EPC presently is evaluating a study by Japanese nuclear vendors on the economics of selecting BWR versus PWR plant type for its proposed Ashihama site. Nuexco expects some delays on the six projects now undergoing licensing in addition to delays to the recently announced plants listed in Table J. Thus, Nuexco presently forecasts 42,000 MWe in operation in 1995. Assuming a 0.25 percent U_{235} tails assay, the forecast mix of PWRs and BWRs, and likely improvements in fuel burnup, a 42,000 MWe capacity will require approximately 13 million pounds U_3O_8 and four million SWUs annually.

Enrichment

As noted in Report 193, significant progress had been made in the approval process for construction of joint fuel cycle facilities at Rokkasho-Mura in the northern part of Japan's main island of Honshu. The facilities will include enrichment, reprocessing, and low-level waste-storage plants. Subsequently, the local government of Aomori Prefecture, in which the facilities will be located, formally granted approval to the combined projects. This action was followed by detailed cooperative agreements between the Prefectural and Rokkasho village governments, Japan Nuclear Fuel Industries (JNFI) and Japan Nuclear Fuel Services (JNFS). JNFI is a private company established in 1985 by the Japanese utilities and other nuclear industry participants to build and operate the enrichment and waste facilities. JNFS, also a private company, was organized by the utilities in 1980 to own and operate the reprocessing facility. The cooperative agreements committed JNFS and JNFI to assure plant safety, as well as to promote the economic and general welfare of the local community. JNFS and JNFI have established local area offices to execute over the next eighteen months site preparatory work and environmental studies necessary for subsequent plant licensing. Current plans for the facilities include:

1. An enrichment capacity of 150,000 SWU per year by 1991, which will be expanded to 1.5 million SWU per year by 1997;
2. A reprocessing capacity of 800 tons of spent fuel per year by 1995, and a storage capacity of 3,000 tons of spent fuel to be completed by 1991.

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Table 2

ANNUAL UPDATE

NUCLEAR POWER PLANTS IN JAPAN

Utility	Unit	Capacity (MWe Net)	Type	COD[1]
Chubu EPC[2]	Hamaoka 1	540	BWR	Mar 1976
	Hamaoka 2	840	BWR	Nov 1978
	Hamaoka 3*	1100	BWR	Sep 1987
Chugoku EPC	Shimane 1	460	BWR	Mar 1974
	Shimane 2*	820	BWR	Feb 1989
Hokkaido EPC	Kyowa Tomari 1*	579	PWR	Jun 1989
	Kyowa Tomari 2*	579	PWR	Jun 1991
Japan Atomic Power Company	Tokai 1	166	GCR	Jul 1966
	Tokai 2	1100	BWR	Nov 1978
	Tsuruga 1	357	BWR	Mar 1970
	Tsuruga 2*	1160	PWR	Jun 1987
Kansai EPC	Mihama 1	340	PWR	Nov 1970
	Mihama 2	500	PWR	Jul 1972
	Mihama 3	826	PWR	Dec 1976
	Takahama 1	826	PWR	Nov 1974
	Takahama 2	826	PWR	Nov 1975
	Takahama 3	870	PWR	Jan 1985
	Takahama 4*	870	PWR	Jun 1985
	Ohi 1	1175	PWR	Mar 1979
	Ohi 2	1175	PWR	Dec 1979
	Ohi 3**	1180	PWR	Jul 1991
	Ohi 4**	1180	PWR	May 1992
Kyushu EPC	Genkai 1	559	PWR	Oct 1975
	Genkai 2	559	PWR	Mar 1981
	Genkai 3*	1180	PWR	Mar 1993
	Genkai 4*	1180	PWR	Mar 1994
	Sendai 1	890	PWR	Jul 1984
	Sendai 2*	890	PWR	Jan 1986
Shikoku EPC	Ikata 1	566	PWR	Sep 1977
	Ikata 2	566	PWR	Mar 1982
	Ikata 3**	890	PWR	Mar 1992
Tohoku EPC	Onagawa 1	524	BWR	Jun 1984
	Maki 1**	825	BWR	1995
Tokyo EPC	Fukushima I-1	460	BWR	Mar 1971
	Fukushima I-2	784	BWR	Jul 1974
	Fukushima I-3	784	BWR	Mar 1976
	Fukushima I-4	784	BWR	Oct 1978
	Fukushima I-5	784	BWR	Apr 1978
	Fukushima I-6	1100	BWR	Oct 1979
	Fukushima II-1	1100	BWR	Apr 1982
	Fukushima II-2	1100	BWR	Feb 1984
	Fukushima II-3*	1100	BWR	Jul 1985
	Fukushima II-4*	1100	BWR	Sep 1987
	Kashiwazaki 1*	1100	BWR	Oct 1985
	Kashiwazaki 2*	1100	BWR	Oct 1990
	Kashiwazaki 3**	1100	BWR	Jul 1993
	Kashiwazaki 4**	1100	BWR	Jul 1994
	Kashiwazaki 5*	1100	BWR	Apr 1990
Total In Operation		20,561		
Total Under Construction or Licensing		20,133		
TOTAL		40,694		

*Unit under construction.
**Unit undergoing licensing procedures.
[1]Actual or expected Commercial Operation Date.
[2]EPC = Electric Power Company.
[3]JAPC = Japan Atomic Power Company.

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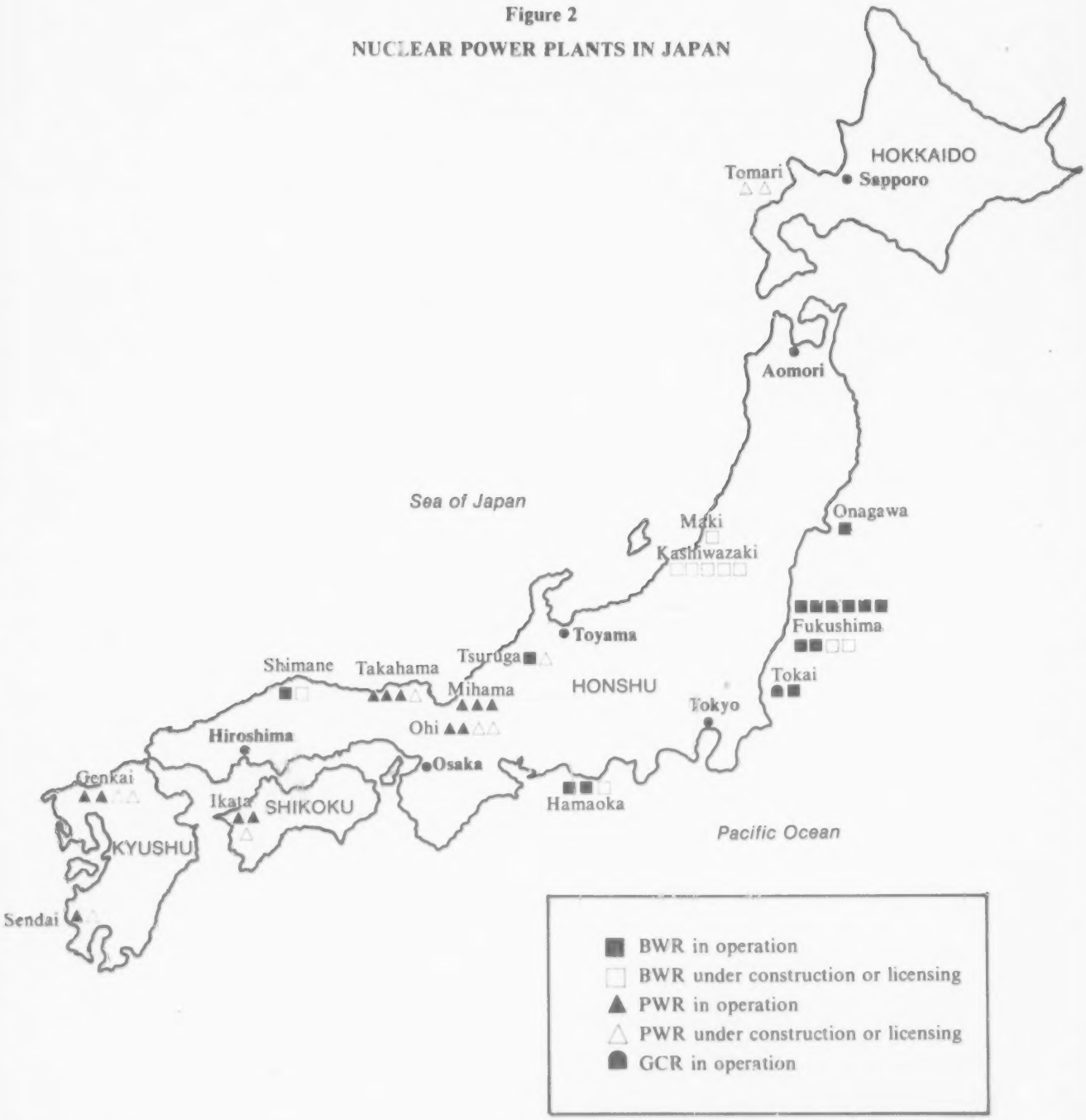
NUEXCO

ANNUAL UPDATE

Figure 2

NUCLEAR POWER PLANTS IN JAPAN



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Enrichment technology has been developed by the Power Reactor and Nuclear Fuel Development Company (PNC) under government sponsorship as part of a national program for greater self-sufficiency in the nuclear fuel cycle. PNC will utilize gas centrifuge technology. PNC recently announced further technical progress in the form of a new centrifuge design which may be 50 percent more efficient than previous centrifuges, while occupying only 40 percent of the installation space. The new centrifuges will be installed in a 200,000 SWU per year demonstration plant currently under construction on the west side of Honshu and scheduled for completion in 1988. The same new design will also be installed in the first phase of the commercial-scale JNFI facility at Rokkasho-Mura.

The recent decision by the US Department of Energy to abandon the Gas Centrifuge Enrichment Plant (GCEP) program in favor of development laser enrichment technology, combined with Cogema's recent emphasis on laser technology, has raised the issue of laser enrichment potential in Japan. Even prior to the DOE announcement, some concerns had been expressed that Japanese nuclear industry should more carefully monitor the possible application of laser enrichment technology. Under government sponsorship, a study team was dispatched to Europe in March to review laser technology status. The visit was followed by a seminar in Japan in May, sponsored by the French government, to promote French laser technology to government and nuclear industry personnel. In June, the Japanese government also sponsored a visit to the USA by a team of specialists. Although laser technology had achieved little emphasis in Japan, it is likely that recent US and European events will alter somewhat Japan's current enrichment program. Considering the advances in domestic centrifuge technology, it is certain that JNFI's centrifuge plant will proceed as planned. However, at the end of June, the Federation of Electric Power Companies (FEPC), disclosed a decision to introduce the laser process into the second phase of the domestic enrichment program. The first phase will proceed as planned, utilizing the centrifuge process. The second-stage plant tentatively is scheduled to be built in Okayama Prefecture (also on Honshu) and to produce 1.5 million SWU per year by 2004 using the laser process.

In other enrichment developments, Asahi Chemical Company announced the completion of an ion-exchange plant capable of enriching uranium. In a program jointly sponsored by the government Science and Technology Agency (STA), Asahi Chemical has completed the installation of a model plant in Miyazaki Prefecture, on the island of Kyushu, capable of producing 1,000-2,000 SWU per year. Test operation will begin in late 1985, and the equivalent of $60 million has been allocated for the seven-year development program which began in 1984. Two-thirds of the program is sponsored by STA. Asahi Chemical has already produced kilogram quantities of uranium enriched to three percent U_{235}. No technical or economic details of the process have been made public. The an-

Table 3

JAPANESE UTILITIES' PLANNED NUCLEAR UNITS

Unit	Utility	MWe	Type	COD[1]
Onagawa 2	Tohoku EPC[2]	825	BWR	Jul 1994
Higashidori 1	Tohoku EPC	1100	BWR	Oct 1994
Namie-Odaka	Tohoku EPC	825	BWR	After 1996
Hamaoka 4	Chubu EPC	1100	BWR	Jul 1994
Ashihama 1	Chubu EPC	1100	—[3]	Dec 1994
Ashihama 2	Chubu EPC	1100	—[3]	Sep 1995
Noto 1	Hokuriku EPC	540	—[3]	Mar 1993
Hohoku 1	Chugoku EPC	1100	—[3]	Nov 1995
Hohoku 2	Chugoku EPC	1100	—[3]	Nov 1997
	TOTAL	8,790		

[1]COD = Expected Commercial Operation Date.
[2]EPC = Electric Power Company.
[3]Reactor type not yet defined.

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nouncement emphasized that the process could not produce military-grade enriched product, in accordance with non-proliferation objectives.

In a related action, MITI suggested the Japanese utilities should consider building a facility for conversion of U_3O_8 to uranium hexafluoride (UF_6). The facility should have enough capacity to meet the needs of the new enrichment facility at Rokkasho-Mura. MITI has initiated a two-year study of the economics of a domestic conversion facility, possibly to be located in conjunction with the Rokkasho-Mura enrichment facility. Currently, the Japanese utilities utilize overseas converters for all of their conversion needs. As in other areas of the fuel cycle, it would appear that some degree of domestic conversion capacity will be desired for further nuclear power self-sufficiency.

Natural Uranium Developments

International Resources Corporation (IRC) of Japan recently announced the continuation of its exploration program in Niger. IRC is a company owned jointly by Arabian Oil of Japan, Tokyo EPC, Kansai EPC, Chubu EPC, and several trading and financial groups in Japan. Since 1975, in cooperation with Onarem (Office National des Ressources Miniere) of Niger, IRC has been active in two districts of Niger, located approximately 600 kilometers north of Niamey. In the late 1970s IRC confirmed deposits estimated at 10,000 tons U_3O_8 with ore grades of approximately 0.25-0.3 percent at one of the sites. IRC also has completed preliminary evaluation in one of the districts, which indicated an additional 6,000 tons U_3O_8 with ore grades in the range of 0.5-0.6 percent. Further exploration and subsequent development of the two deposits have been delayed for several years because of uncertain market conditions. In the recent announcement, IRC indicated their intent to resume exploration in one of the districts. Under a four-year contract signed in late 1984, IRC will drill 55 test holes from September 1985 to April 1986. Upon completion of the drilling program, IRC will evaluate the economic feasibility of both deposits. If the evaluation is favorable, development work could start as soon as 1988, with commercial production scheduled for 1993. If realized, the project will have begun production approximately ten years later than the originally scheduled production date. The continuation of the IRC program reflects Japan's continuing commitment to its long-term goal of increasing to 25 percent the share of uranium supply acquired from sources with Japanese participation.

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AUSTRALIA

As expected, Western Mining Corporation and BP Australia, joint venture partners in the Olympic Dam (Roxby Downs) project, have announced that the uranium-copper-gold project is commercially viable. A firm decision to proceed with development will be made before the end of 1985; gold production is scheduled to begin in 1987, and uranium and copper production should begin in mid-1988. The partners anticipate annual production will amount to 2,000 metric tons (tonnes) U_3O_8, 55,000 tonnes of copper, and up to 90,000 ounces of gold. The study indicated that the project was viable at slightly smaller ore tonnages than had been planned. The partners concluded that under current conditions a project of this size is justified, while leaving open the option of progressive expansion of production should market opportunities dictate. A joint company, Olympic Dam Marketing Pty. Ltd., has been established to assist with the marketing of the projected output. Development costs for the project are expected to amount to A$550,000,000 in addition to the A$150,000,000 already spent to date.

The project is one of the largest undeveloped base metal resources, containing copper, gold and uranium, as well as recoverable silver and rare earth oxides. Present plans indicate an initial mine life of 30 years. Economic mineralization occurs at depths ranging from 350 to 650 meters. Conventional underground mining methods will be used. Over 60,000 tonnes of ore already have been treated in the metallurgical pilot plant, and approximately 22,000 pounds U_3O_8 have been produced.

Given the inclinations of the partners and the political and economic situation in South Australia, it was almost certain that Roxby Downs would be deemed viable *in some form*. The project has the strong backing of the State government of South Australia, and Australia's Labor Government has approved the project under its limited uranium development policy. The current weak market conditions for all three commodities probably account for the fact that the announced production rates are lower than those originally proposed. Moreover, because the Australian floor price for uranium is approximately twice the current spot price, the uranium will prove the most difficult commodity to market. Internationally, a number of buyers have elected to fill their needs through the late 1980s and early 1990s by purchasing material on the spot market and holding it in inventory for later use. The US enrichment contract has deferred new feed requirements by allowing the use of existing inventories of enriched product.

An aggressive marketing effort by the Roxby Downs partners could provide impetus to other Australian, Canadian and African producers intent on protecting their market shares. It is likely that buyers will closely watch developments at Roxby Downs, as it will provide increased supply diversity and competition. New, large sources of uranium capture the attention of the market, as Canada's Cigar Lake deposit has shown. In view of the Australian floor price, and limited uranium demand in the pre-1990 period, there appears to be no natural niche for the 4.5 million pounds of U_3O_8 expected from Roxby Downs in its early years of production. However, it is possible that some buyers will be motivated to purchase from this source in smaller quantities to obtain an initial position in this large, long-term supply source.

UNITED STATES

The Department of Energy (DOE) recently chose Atomic Vapor Laser Isotope Separation (AVLIS) over the advanced gas centrifuge as the next US enrichment process. (For a discussion of the AVLIS process, see page 13 of Report 201, May 1985.) To avoid funding research and development of two technologies, DOE will end support for the gas centrifuge enrichment plant (GCEP) currently under construction in Portsmouth, Ohio. In a further cost-reducing measure, the gaseous diffusion plant at Oak Ridge, Tennessee will be placed on standby status.

Energy Secretary John Herrington announced these decisions in early June as part of a revised business strategy to stem the ongoing erosion of DOE's market share, which has declined by approximately 50 percent in recent years. DOE SWU prices are the highest in the market and will remain so even if, as expected, FY86 prices are reduced to $125.00 per SWU from the FY85 price of $135.00 per SWU.

A year-long study conducted by a DOE-appointed Process Evaluation Board provided the basis for the decision to choose AVLIS over the GCEP program, despite the fact that $2.6 billion has been spent on the Portsmouth GCEP project. (1,100 centrifuge machines have been installed, and the planned installation of 24,000 centrifuges was expected to cost an additional $2.4 billion.) The Board found that AVLIS technology has "better potential for low cost and reliable production of separative work units in the future," being less capital-intensive and having a lower estimated SWU cost.

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RECENT DEVELOPMENTS

Furthermore, the Board found that AVLIS has a greater potential for technology improvement which could lead to further cost reductions. Another important advantage of AVLIS stemmed from the conclusion that it could be funded within the financial constraints projected for enrichment, while a continuation of the GCEP would require additional funding. DOE expects to spend $80 million on AVLIS research in FY86, and could be ready to deploy the technology as early as 1989. A 10-million SWU per year plant could enter operation in the mid-1990s.

DOE decided to halt production at the Oak Ridge diffusion plant after extensive financial analyses indicated that $50 million could be saved annually if the plant was put on standby status. The facility could be brought back into operation if the demand for enriched uranium increases, but at present DOE's three diffusion plants are operating at only 40 percent of their combined capacity. High electricity costs at the Oak Ridge plant, due to old power contracts with the Tennessee Valley Authority, and the plant's relatively small capacity contributed to the decision.

At present, it is premature to draw any firm conclusions concerning the impact of AVLIS on future markets for uranium and SWU. However, it is not too early to note that, given certain cost and technical parameters which are conceivable, AVLIS could operate efficiently at tails assays well below 0.2 weight-percent (w/o) U_{235}. Lower tails assays for enrichment, of course, translate into reduced uranium needs and increased SWU needs. Table 4 illustrates these relationships for a typical 1,000-MWe PWR reload. Moreover, it has been reported that AVLIS operates more efficiently with depleted feed than with natural uranium. If true, DOE's stockpile of 0.20-0.30 w/o tails material would emerge as one of the world's largest uranium supplies. If the cost of enriching tails material with AVLIS was as low as $30 per SWU, by 1995 the DOE tails stockpile could yield the equivalent of 200 million pounds U_3O_8 at a cost of less than $20 per pound.

AMPLIFICATIONS

Two points in last month's article on the nuclear fuel market in the Federal Republic of Germany (Report 202, page 15) require amplification.

1. On page 16, Table 2, the governing political party for the country as a whole is a coalition of the Christian Democratic Union (CDU), the Christian Social Union (CSU), and the Free Democratic Party (FDP), not simply the CDU as indicated in the table.

2. On page 20, it is stated that RBW (Rheinisch-Braunkohlenwerke AG) is Germany's largest coal producer. In actuality, RBW is the leading *lignite*, or brown coal, producer in the FRG.

Table 4

CHANGES IN URANIUM AND SWU REQUIREMENTS AT VARYING TAILS ASSAYS[1]

Tails Assay	Natural Uranium Requirements (lbs. U_3O_8)	Change in U_3O_8 Requirements from 0.2 Tails Assay (lbs. U_3O_8)	Percent Change	SWU Requirements	Change in SWU Requirements from 0.2 Tails Assay	Percent Change
0.30	360,000	+61,000	+20	76,000	– 20,000	– 21
0.25	326,000	+27,000	+ 9	85,000	– 11,000	– 12
0.20	**299,000**	**0**	**0**	**96,000**	**0**	**0**
0.15	276,000	–23,000	– 8	110,000	+ 14,000	+ 15
0.10	257,000	–42,000	–14	132,000	+ 36,000	+ 38
0.05	241,000	–58,000	–19	172,000	+ 76,000	+ 79
0.01	230,000	–69,000	–23	274,000	+178,000	+185

[1]Assumes requirements for a typical PWR reload with 3.5-percent enrichment, a 65-percent capacity factor, and a 12-month cycle.

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HISTORICAL MARKET DATA

EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1980

Determined as of the last day of the month indicated

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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	**15.00**						

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	**14.60**						

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	**1.60**						

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GOVERNMENT STATISTICS

AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry—All Groups[1] (1969=100)	Award Rates of Pay Indexes Australia—Adult Males In Mining Wage and Salary Earners, Weekly Rates[2] (1976=100)
1983 Avg.	401.2	181.8
Jan 1984	399.2	188.6
Feb 1984	402.5	188.5
Mar 1984	403.9	188.3
Apr 1984	404.2	196.2
May 1984	403.8	197.0
Jun 1984	404.9	197.4R
Jul 1984	408.5	197.4R
Aug 1984	413.3	197.4R
Sep 1984	412.1	197.4R
Oct 1984	408.6	197.4R
Nov 1984	407.3	197.4R
Dec 1984	406.0	197.4R
Jan. 1985	409.4	197.4R
Feb 1985	416.0R	197.4R
Mar 1985	426.7R	197.4R
Apr 1985	—	202.3

P = Preliminary R = Revised since last month

CANADA

		Wage-earner Data: Average Hourly Earnings (C$)[2]					
	Industry Selling Price Index: Manufacturing[1] (1971=100)	Uranium Mines (SIC 057)	Metal Mines* (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Metal Industries Non-ferrous[4] (SIC 296)	Primary Metal Industries Non-ferrous[4] (SIC 298)	Chemicals and Chemical Products[5] (SIC 372-379)
1983 Avg.	298.8	—	—**	14.30	—	—	11.17
May 1984	310.6	18.48	15.64	15.06	12.11	10.16	11.65
Jun 1984	311.0	18.08	15.48	14.80	12.38	10.40	11.66
Jul 1984	312.7	17.81	15.72	14.92	12.53	10.18	11.82
Aug 1984	312.7	17.24	15.36	14.92	12.44	10.34	11.78
Sep 1984	312.3	17.68	15.96	15.34	12.51	10.52	11.90
Oct 1984	312.3	17.64	16.15	15.26	12.69	10.56	11.96
Nov 1984	313.6	18.04	16.13	15.43	12.47	10.51	11.96
Dec 1984	314.2	17.95	16.39	15.60	12.16	10.40	11.99
Jan 1985	315.8	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	316.4	18.78	16.41	15.68	12.52	11.05	12.06
Mar 1985	317.5	18.24	16.21R	15.43R	12.43R	10.97R	12.02R
Apr 1985		18.63P	16.39P	15.74P	12.77P	11.21P	12.06P

P = Preliminary R = Revised since last month

For annual averages prior to 1983, and for notes pertaining to these statistics, see pages 23–26 of Report 190 of June 1984.

* The 1980 average for Metal Mines was incorrectly reported as 10.59. The correct average is 10.58 (see Report 190).

** Two different methods were used in the 1983 "Metal Mines" category in reporting survey data, and Statistics Canada did not publish a 1983 average. The March 1983 figure for the old method was 14.73 and for the new method was 14.84. The published average for 1983 in Report 190 was a Nuexco calculation based on the available monthly statistics for 1983 with the exception of the March figure, where only the 14.84 value was taken into account.

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GOVERNMENT STATISTICS

UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
	Industrial Commodities (1967=100)	All Commodities (1967=100)	(1967=100)	(1972=100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
May 1984	323.3	311.7	309.7	—	12.99	13.37	11.02	8.89
Jun 1984	323.9	311.4	310.7	222.40	12.96	13.40	11.03	8.91
Jul 1984	324.0	312.0	311.7	—	13.02	13.36	11.12	8.95
Aug 1984	323.5	310.9	313.0	—	13.10	13.51	11.13	9.00
Sep 1984	322.3	309.5	314.5	224.57	13.20	13.39	11.23	9.08
Oct 1984	323.2	309.4	315.3	—	13.23	13.53	11.32	9.09
Nov 1984	323.8	310.4	315.3	—	13.23	13.76	11.35	9.15
Dec 1984	323.0	309.9	315.5	226.10	13.28	13.66	11.37	9.27
Jan 1985	322.9R	309.5R	316.1	—	13.29R	13.70R	11.39R	9.33R
Feb 1985	322.5	309.2	317.4	—	13.30R	13.73R	11.39R	9.33R
Mar 1985	322.6	308.7	318.8	229.01	13.29R	13.95R	11.37R	9.39R
Apr 1985	323.8	309.3	320.1	—	13.47P	13.56P	11.47R	9.39R
May 1985	325.3	309.9	321.3	—	—	—	11.45P	9.42P

P = Preliminary R = Revised since last month

For annual averages prior to 1983, and for notes pertaining to these statistics, see pages 23-26 of Report 190 of June 1984.

REPUBLIC OF SOUTH AFRICA

	Average Declared Working Costs per per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982=100)[2]	Consumer Price Index[3] (1975=100)[4]	Producer Price Index All Groups[5] (1975=100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1983 Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
Jan 1984	—	—	274.7	283.3	689,807	326,619
Feb 1984	—	—	278.4	286.5	702,553	335,906
Mar 1984	55.30	123.1	281.9	288.0	715,628	342,332
Apr 1984	—	—	286.1	290.2	712,963	327,550
May 1984	—	—	288.3	292.6	710,040	327,937
Jun 1984	56.95	126.2	291.2	295.3	717,009	347,121
Jul 1984	—	—	295.1	296.0	717,121	369,964
Aug 1984	—	—	297.0	300.8	721,905	361,357
Sep 1984	60.64	133.2	299.9	304.1	721,470	359,218
Oct 1984	—	—	303.7	308.7	717,865	363,755
Nov 1984	—	—	307.4	312.8	717,396	369,771
Dec 1984	62.92	138.6	309.4	315.9	701,198	365,234
Jan 1985	—	—	177.1*	166.6*	711,366	376,777
Feb 1985	—	—	182.8*	171.3*	—	—
Mar 1985	64.48	142.4	183.6*	173.0*	—	—
Apr 1985	—	—	187.4*	174.0*	—	—
May 1985	—	—	189.5*	—	—	—

*The basis for calculation for these indices has been revised to January 1980 = 100.

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